ATOMIX: Analysing **T**urbulence **O**cean **MIX**ing observations
WG #160 – Third annual update 2023

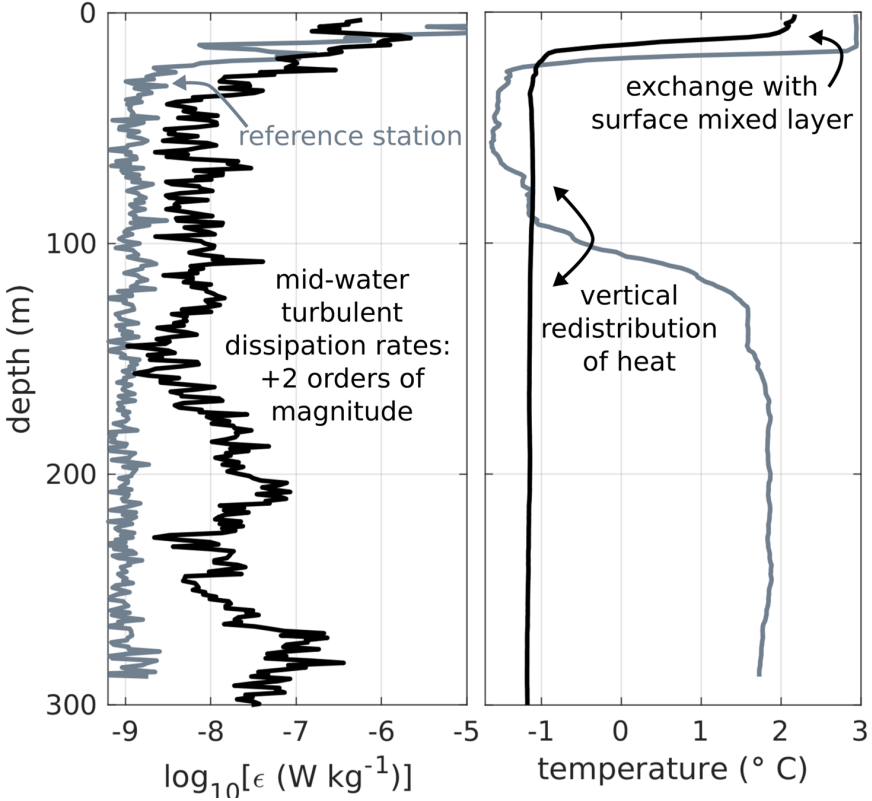
Develop best practices, quality-control measures, and algorithms' benchmarks to estimate the ocean dissipation rate of turbulence kinetic energy (mixing) from observations

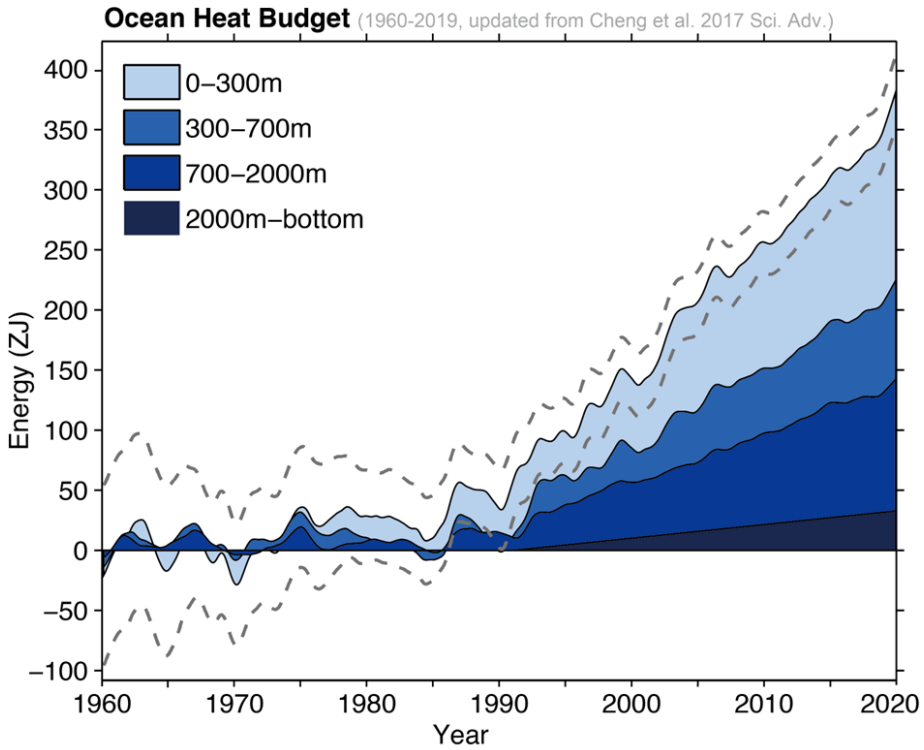
Co-chairs: Cynthia Bluteau (Canada), Ilker Fer (Norway), Yueng-Djern Lenn (UK)
Other Full Members: Ryuichiro Inoue (Japan), Arnaud LeBoyer (USA), Zhiyu Liu (China), Rolf Lueck (Canada), Amelie Meyer (Australia), Craig Stevens (New Zealand), Danielle Wain (USA)

Associate-Members: Marcus Dengler (Germany), Jenson George (India), Peter Holtermann (Germany), Natasha Lucas (UK), Justine McMillan (Canada), Stephen Monismith (USA), Julia Mullarney (New Zealand), Sarah Nicholson (South Africa), Kirstin Schulz (USA)

International Science Council
SCOR
Scientific Committee on Oceanic Research

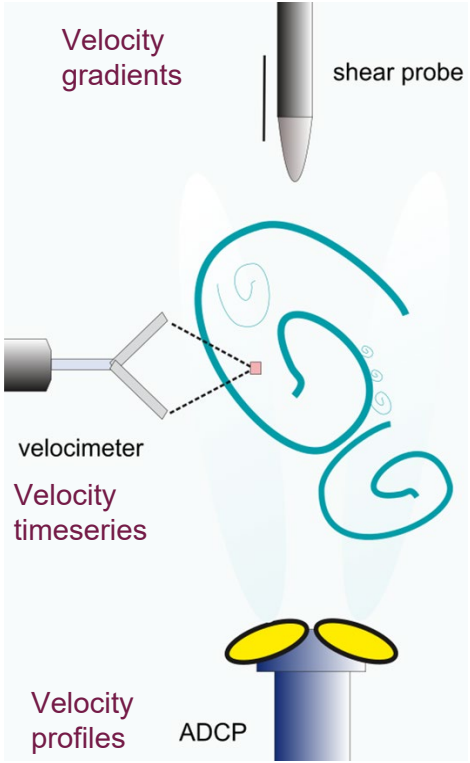
Fundamental quantity – turbulent kinetic energy dissipation ϵ for estimating redistribution of heat, salt, nutrients, etc

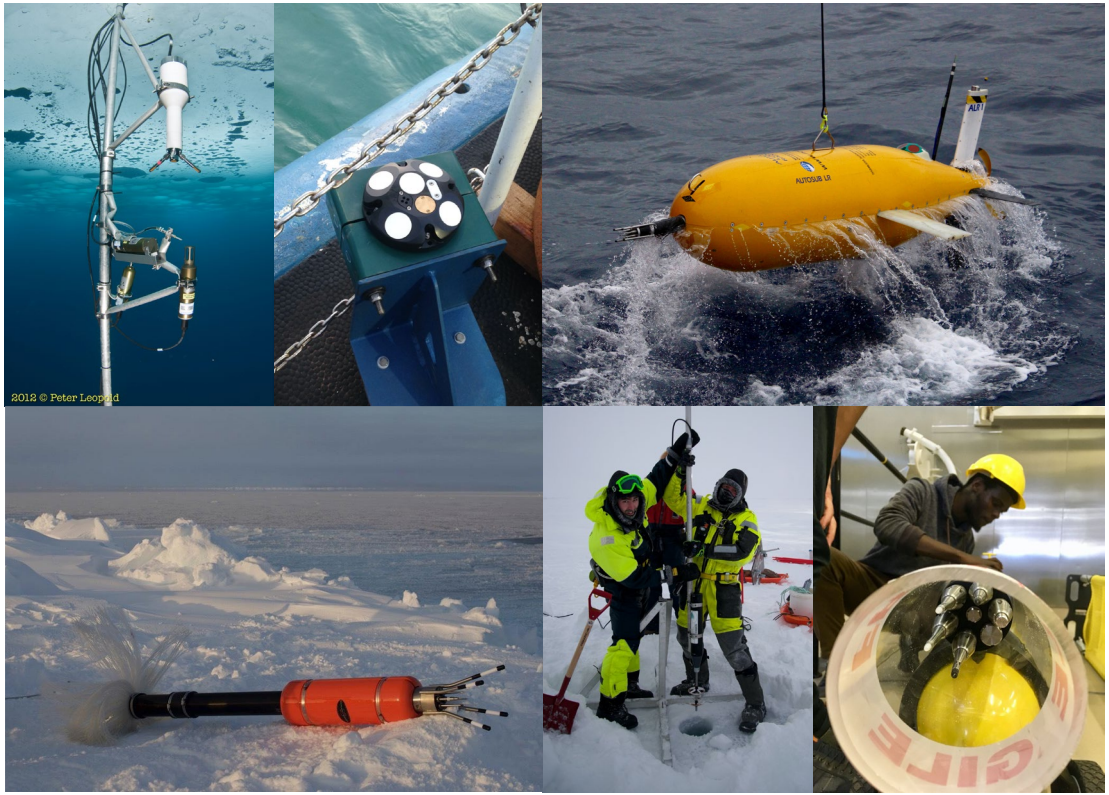




Laptev Sea continental slope, summer 2018 (credit: Kirstin Schulz)

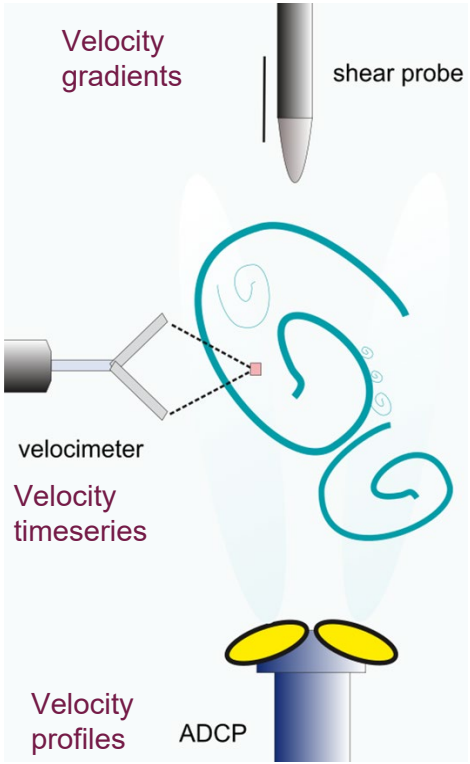
Three subgroups for each type velocity-based technique used to obtain dissipation ϵ





ATOMIX

Many steps and decisions before obtaining ϵ



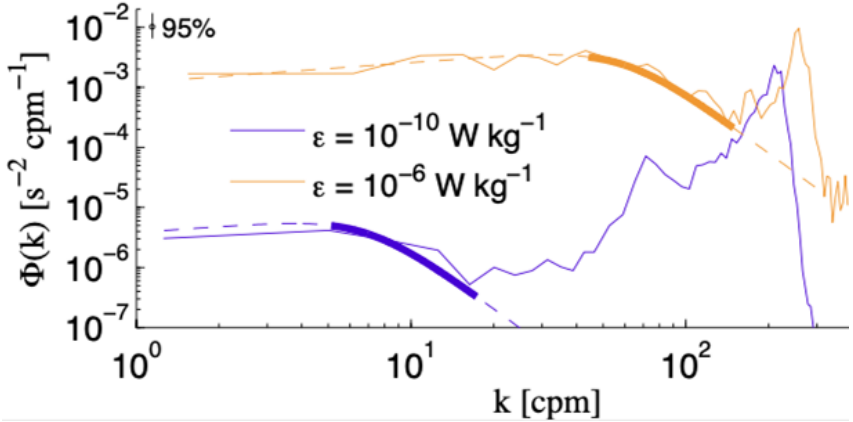
Deployment choices

Pre-processing

Raw data quality checks

Theoretical assumptions

Statistical and spectral methods



Quality controlled ϵ

- Can estimate diapycnal mixing
- Assess mixing parameterizations in global & regional models

ATOMIX

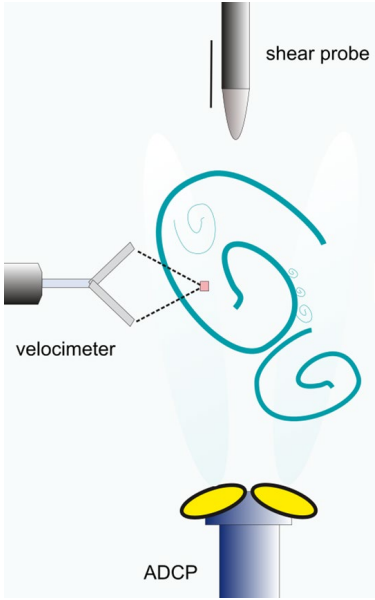
Terms of Reference

1. Develop **best practices** for obtaining dissipation rate ϵ

1. Establish database of **benchmark datasets to validate processing algorithms**

1. Develop **quality control guidelines for publishing and archiving** turbulence quantities

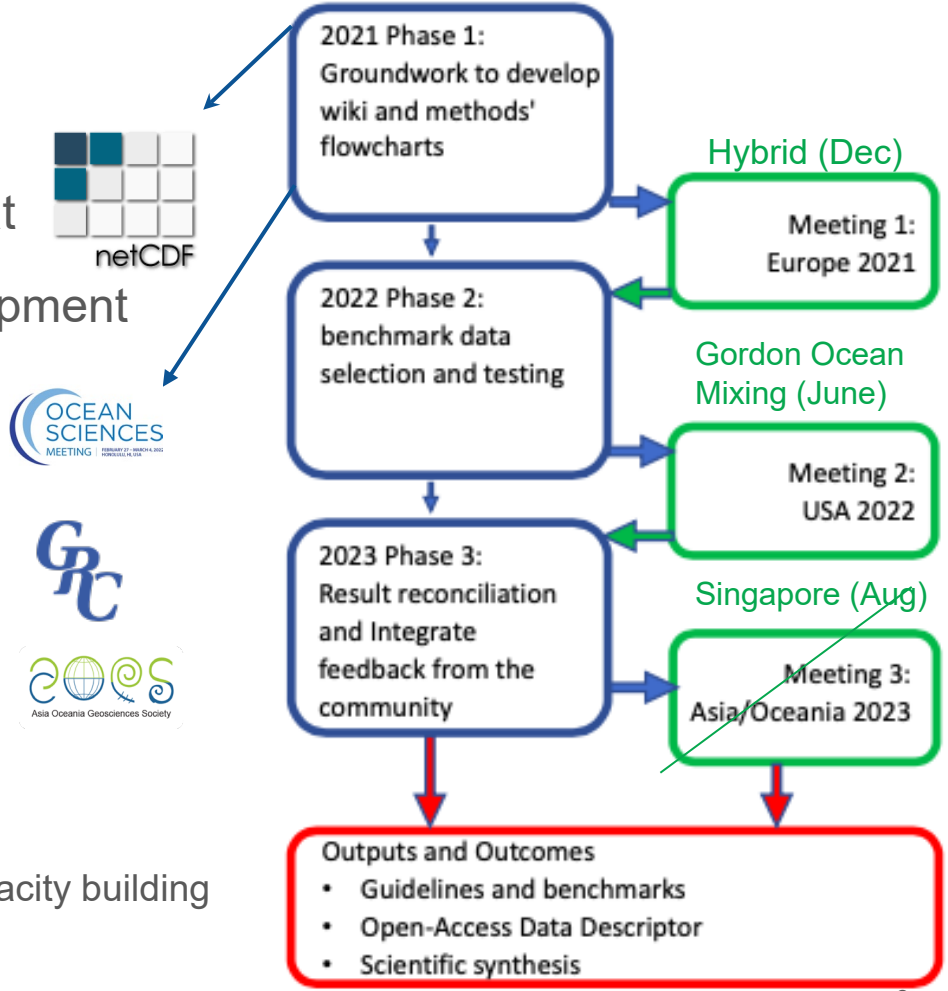
1. **Build capacity** by creating a **collaborative,** living **wiki-platform** for processing observations



Phase 1 – completed

- Developed benchmark dataset format
- Create Wiki on best practices development
- Townhall and presentations
  - Ocean Sciences Feb 2022 - Townhall
  - Gordon Ocean Mixing Jun 2022 -poster
  - AOGS Aug 2022 - presentation
  - Newsletters (2x) to community (~100 pp)
- Hybrid meeting Boston (June 2022)

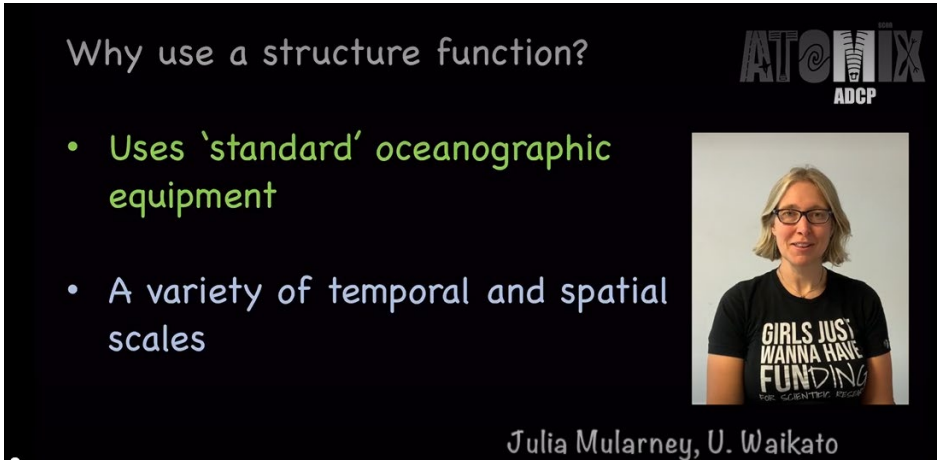
Developed testing plan, and brainstorm format of capacity building



Phase 2 - almost done

2023 onwards

- Finish benchmark testing for all platforms/datasets selected
- Developed framework for training videos on best practices, instrument setup and how to use benchmarks
- Revisit wiki with updated best practices



2021 Phase 1: Groundwork to develop wiki and methods' flowcharts

+2023

2022 Phase 2: benchmark data selection and testing

2024

~~2023~~ Phase 3: Result reconciliation and Integrate feedback from the community

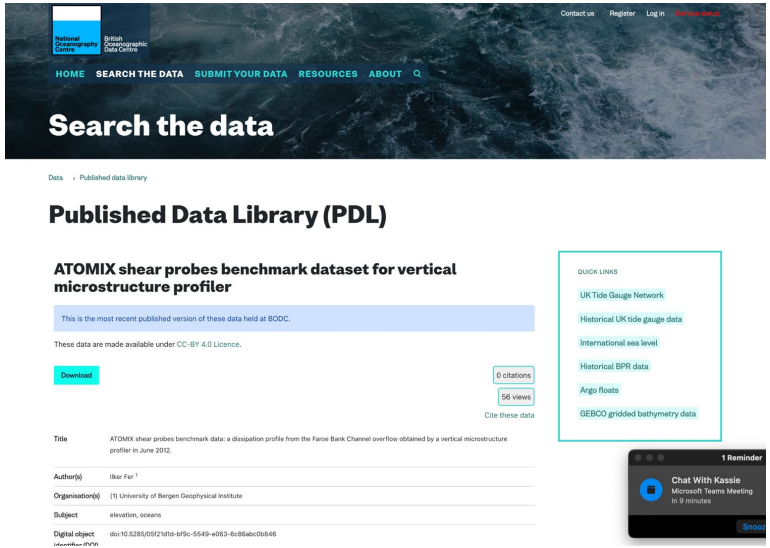
Phase 3 – activities:

2024

- Provide ATOMIX community access to the benchmarks (~100x people)

  Shear probes datasets published at BODC:

  ADCP & ADV datasets in final stages of testing



2021 Phase 1: Groundwork to develop wiki and methods' flowcharts

+2023

2022 Phase 2: benchmark data selection and testing

2024

~~2023~~ Phase 3: Result reconciliation and Integrate feedback from the community

2024 BOSTON HYBRID

Phase 3 – activities:

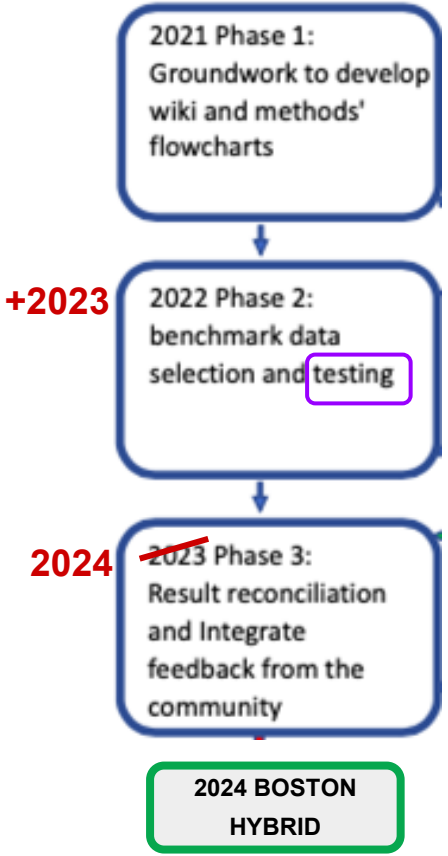
2024

- Publications on best practices and usage of benchmark datasets:
  - *Shear probes = 2 publications:*

Lueck R, Fer I, Bluteau C, Dengler M, Holtermann P, Inoue R, LeBoyer A, Nicholson SA, Schulz K, Stevens C. Best practices recommendations for estimating dissipation rates from shear probes. Frontiers in Marine Science. 2024 Mar 19;11:1334327.

Fer I, Dengler M, Holtermann P, Le Boyer A, Lueck R. ATOMIX benchmark datasets for dissipation rate measurements using shear probes. Scientific Data. 2024 May 21;11(1):518.

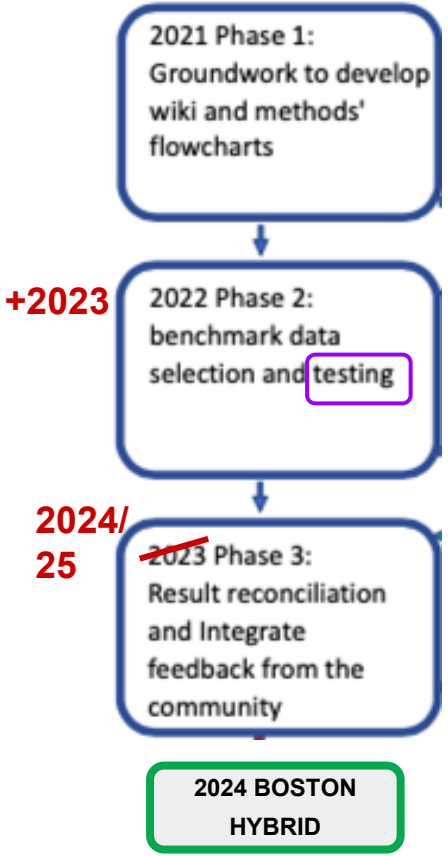
  - *ADV manuscript due for submission by end 2024*
  - *ADCP manuscript to be completed by end 2024.*



Phase 3 – activities ongoing

2024/2025

- Updating the wiki pages to ensure clarity of presentation and fidelity with publications - ongoing for all groups
- Video curriculum and framework agreed upon at 2024 Boston meeting - preparation of material by each subgroup ongoing. We are seeking professional video editing to make final versions.
- Publish the data papers and benchmark datasets for ADCP and ADV subgroups by summer 2025.



Summary

ATOMIX is developing **best practices**, **quality-control measures,** and **benchmark datasets** to test algorithms to estimate energy dissipation estimates (ϵ) from observations.

Subscribe to our mailing list for updates

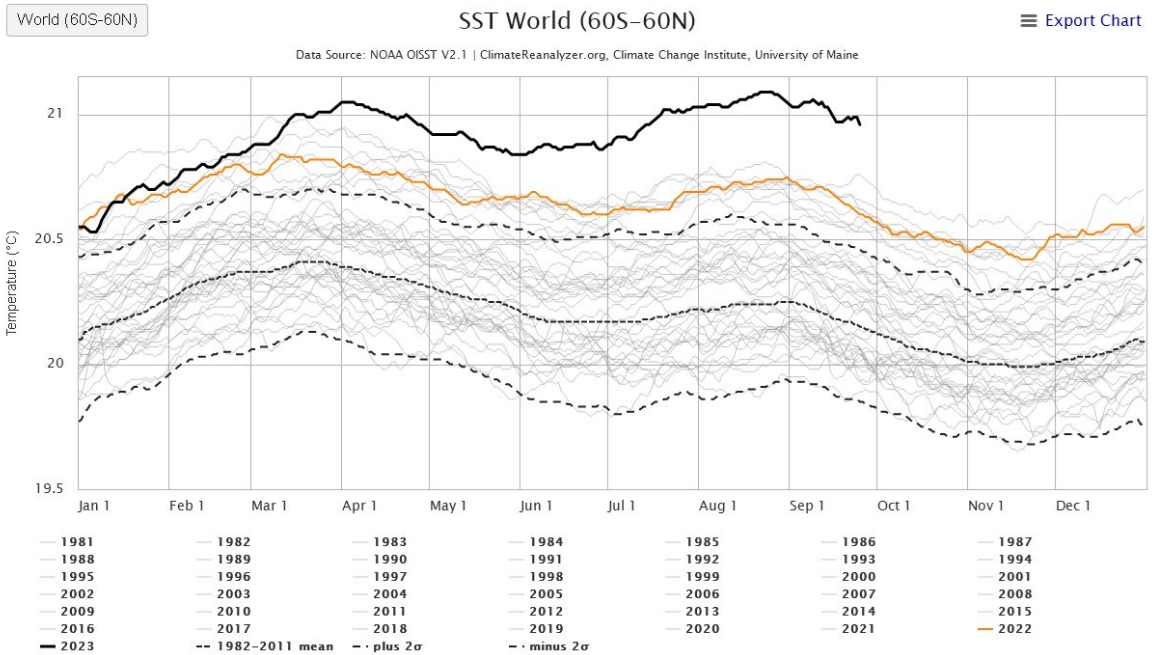
Visit our wiki!

International Science Council
SCOR
Scientific Committee on Oceanic Research

End of talk – additional slides

New slide???Increasing need for understanding ocean mixing

The need for systematic and reliable quantification of mixing is becoming more urgent with changes in SST and ocean circulation.



https://climatereanalyzer.org/clim/sst_daily/